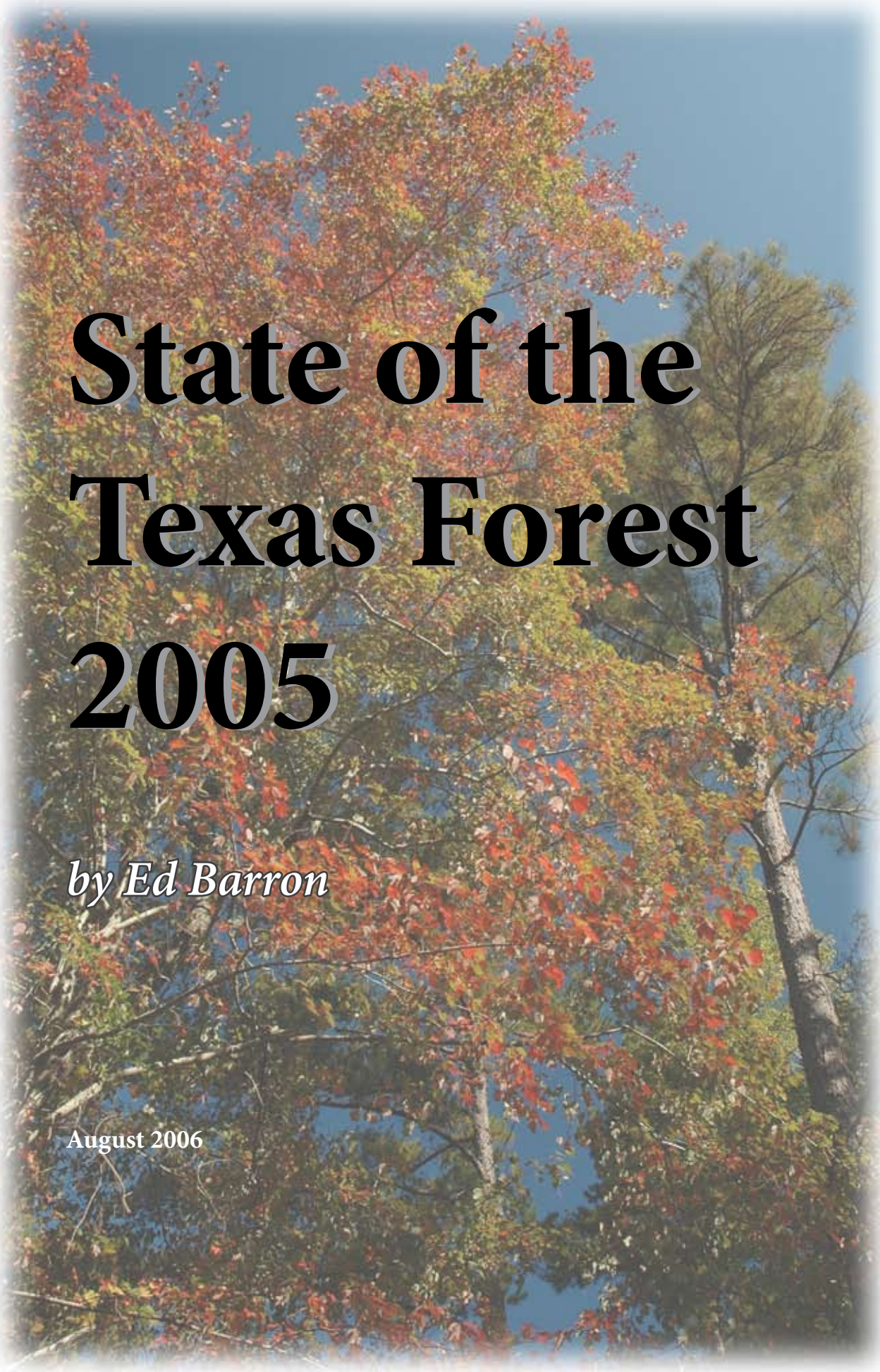

State of the Texas Forest 2005

by Ed Barron

August 2006

Acknowledgements

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Executive Summary

Texas Forest Service completed the data collection of the 2003 Forest Inventory and Analysis in June 2003. The Southern Research Station of the United States Department of Agriculture (USDA) Forest Service provided compiled data and tables in 2005. These data provide information on forest area, volumes, ownership, forest types, growth, removals and mortality.

Volume of softwood growing stock in East Texas was 9.3 billion cubic feet in 2003. Hardwood volume in 2003 was 6.4 billion cubic feet. In 2003, East Texas had 11.9 million acres of timberland, an increase of over 100,000 acres since 1992.

Timberland ownership changed in 2002 from the historic trend of 63 percent family forest owner, 29 percent forest industry, and 8 percent public, as industrial ownership decreased to 16 percent. The remaining 13 percent of former industrial lands are now owned by Timber Investment Management Organizations (TIMOs), Real Estate Investment Trusts REITs), and other investment groups. East Texas has approximately 198,000 family forest owners. Approximately 87,000 of these landowners own 327,000 acres in parcels of 1 to 9 acres, indicating the extent of forest fragmentation.

In 2003, pine forests totaled 5.6 million acres, an increase of 30 percent since 1992, while upland hardwood acres decreased by 45 percent to 1.8 million acres.

East Texas sawmills increased output by 8 percent in 2004 to 1.9 billion board feet, while paper and paperboard production increased 6 percent to 2.56 million tons. Structural panel production increased by 5 percent over 2003 to 2.86 billion square feet. Hardwood lumber production increased 13 percent over 2003 to 325 million board feet in 2004.

Globally, the forest products markets have been affected by the opening of China to capitalism, foreign investment and trade as well as the collapse of the former Soviet Union. While world timber demand is expected to rise over the next 20 years, the timber supply forecast is still expected to be only 77 percent of demand by 2020.

Between 1992 and 2003, annual removals of softwood on family forest lands exceeded growth by 20 percent. Conversely, on industrial lands, removals were only 78 percent of growth during this period. Hardwood growing stock removals are only 82 percent of growth. Average annual mortality of softwood growing stock in East Texas from 1992 to 2003 was 65.4 million cubic feet, while hardwood average annual mortality was 62.1 million.

Infestations of southern pine beetle have been low- to non-existent in East Texas since 1997. However, imported pest organisms, Sudden Oak Death, and invasives like Giant Asian Dodder are of concern. In addition, Hurricane Rita made landfall on September 24, 2005, and affected an estimated 967 million cubic feet of East Texas growing stock.

The Forest Legacy Program was officially begun in Texas in 2004. However, cost-share programs for reforestation continue to reforest fewer acres. Tax incentives for timber production have become more available.

The forest-based economy in 1999 produced $12.9 billion of direct economic impact in Texas, while the direct economic impact of the forest sector in East Texas was $6.1 billion for goods and services, supporting 77,300 jobs.

The Texas Timber Productivity Tax System has been improved through changes to merge Northeast and Southeast Texas, stabilizing the capitalization rate, including small sawtimber as a product, and including gatewood in timber price reports.

Texas Forest Service encourages the forestry community to prevent or reduce silvicultural non-point source pollution through its Best Management Practices program. The current level of voluntary BMP implementation is 91.7 percent.

In the South, softwood harvests are projected to increase by 56 percent between 1995 and 2040 under the base case scenario. Plantation acreage is projected to increase from 30 million acres in 1997 to 53.6 million acres in 2040 — an increase of 24 million acres. Growth in hardwoods is expected to exceed removals until 2025.

Opportunities for Texas abound in the arena of ecological services, including water credits, carbon sequestration and biomass for energy or chemical production. Tops, limbs and cull trees produced an estimated 2.8 million tons of available logging residue in 2003.

The surplus timber supply in Southeast Texas provides an excellent opportunity for a new Oriented Strand Board (OSB) facility and a pine sawmill. The surplus hardwood supply could support a grade hardwood mill in the region as well. Hardwood opportunities also include grade lumber production.

Future resource development depends on an increased timber supply. Options for increasing reforestation exist that could increase tree planting by more than 37,400 acres per year to meet the current forest sustainability needs, or up to 74,800 acres per year for increased economic growth.

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Texas Forest Trends

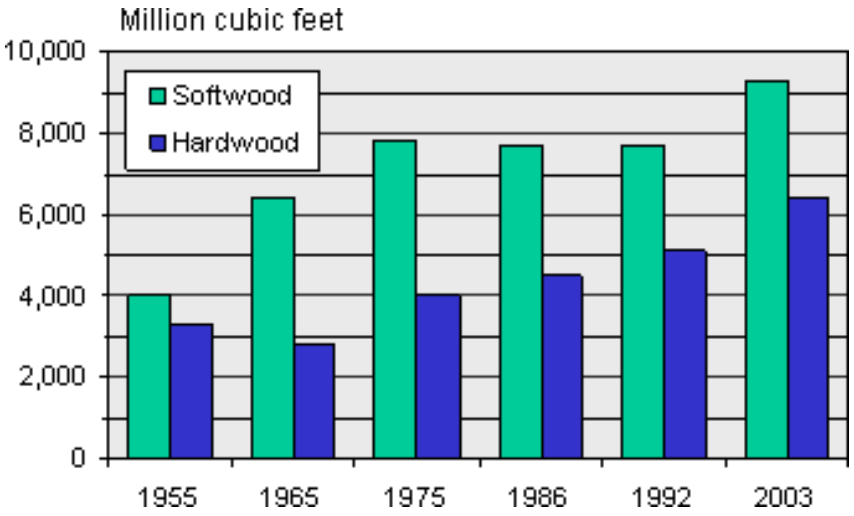
Texas Forest Service, in cooperation with the Southern Research Station of the USDA Forest Service, conducts a continuous forest inventory to measure the status of all the forest resources in the state. The Forest Inventory and Analysis (FIA) program consists of a series of permanently established plots that are remeasured every 5–10 years to determine growth, composition and mortality of forests, as well as land use changes and wildfire hazard in the state. Data is compiled and reported on a county, regional and statewide basis, ensuring the confidentiality of individual landowner information.

Previous inventories were conducted in the 43 counties of East Texas in 1935, 1955, 1965, 1975, 1986 and 1992. Increased demand for forest products and increasingly restricted timber supplies from regions such as the Pacific Northwest have stimulated more intensive timberland management in the South and have necessitated shorter intervals between inventories. The 1998 Farm Bill replaced the periodic inventories of the past with a continuous inventory system, where 20 percent of the plots in East Texas are measured each year. However, due to the long interval since the previous inventory (1992), the first cycle (entire remeasurement) of the new annual system was accelerated and completed in two years. Field data collection began in September 2001, and the 2003 inventory was completed in East Texas in June 2003. Results from the inventory of East Texas timberland are used to determine future fiber availability for mills in the area, as well as to identify areas of opportunity for forest-based economic development. They also help determine the effectiveness of land management techniques and programs that encourage reforestation and forest stewardship. Future inventory data in East Texas will be collected at the 20 percent rate and will be used to update the inventory annually.

The 1998 Farm Bill also expanded the scope of the inventory to include all rural lands in the state. In January 2004, Texas Forest Service began collecting inventory data from West Texas, which refers to all areas of the state outside of East Texas. Ten percent of plots in West Texas are measured annually and include metrics to define fuel loading as well as vegetative characteristics. This expanded inventory will increase knowledge of statewide issues, such as fire fuel loading, tree regeneration rates, invasive species encroachment and overall forest health. The research findings will enable Texas ranchers and landowners to measure the spread of unwanted mesquite and juniper that occupy grazing pastures and consume scarce water. With more information on the spread of these encroaching species, local organizations can develop plans for removing invasive species and thus maximize land efficiency.

The FIA program provides objective and scientifically credible information and is part of the universal benchmark for measuring the sustainability and success of natural resource and land management practices. Results of this research will help landowners make informed decisions about managing their land for desired outcomes, whether it is to run cattle, attract wildlife or harvest trees for income.

Figure 1. Growing stock inventory by species group, 1955-2003.



Volumes

Softwood

Volume of softwood (pine) growing stock in East Texas rose from 4.0 billion cubic feet (bcf) in 1954 to 9.3 bcf in 2003. Softwood volume doubled between 1955 and 1974, increasing five percent per year. For the next seventeen years, it remained flat at 7.9 bcf. Since 1992, it has risen 1.8 percent annually to the current 9.3 bcf. This increase is due to large capital investments by forest industry since the early 1990s for intensive timber management on their lands to meet future timber needs and to adjust for lands taken out of production for environmental purposes.

Hardwood

Hardwood inventories declined between 1955 and 1965. The trend then reversed and steadily increased 2.9 percent annually for the next twenty years to 4.5 bcf in 1986. Between 1986 and 2003, annual growth slowed slightly to 2.5 percent, increasing in the 2003 inventory to 6.4 bcf, almost double the volume since the low point in 1965.

Regional Trends

In Northeast Texas, softwood inventory dropped 39 percent between 1935 and 1955, then the trend reversed and volumes rose four-fold over the next 48 years. During this same 48-year period, softwood inventory in Southeast Texas increased only 90 percent. Hardwood inventory tripled over the last 48 years in Northeast Texas, versus only a 40-percent increase in Southeast Texas.

Ownership

Land Use Changes from 1992 Inventory to 2003 Inventory

Total land area in the 43-county inventory area is 21.5 million acres. Of this, 11.9 million acres are classified as commercial timberland — an increase of 105,000 acres since 1992. Total timberland acreage has been relatively stable over the past several inventories; however, changes between forestland and non-forestland and regional (Northeast vs. Southeast Texas) differences are significant. Between the 1992 and 2003 inventory, 603,500 acres were converted from agriculture (mainly pasture land) to development, forest land or other uses. Development and other land use, excluding forest and agriculture, gained 509,500 acres from 1992 to 2003. Regionally, Northeast Texas gained 270,000 acres of forest land, while Southeast Texas lost 159,000 acres. In general, land in Southeast Texas, especially north of Houston, is converting from forest to developed land, whereas in Northeast Texas, pastureland is reverting to forest.

Ownership Changes

In 2002, after much of the inventory fieldwork was completed, 1.5 million acres of industrial forest lands were sold to investor groups. The new owners are mainly Timberland Investment Management Organizations (TIMOs), organized generally as limited liability partnerships (LLPs), and Real Estate Investment Trusts (REITs). TIMO clients are institutions, pension funds, foundations and high net-worth individuals using timberland in their portfolios to reduce volatility, add predictability and offer competitive returns. To selling companies, the sales provided a cash market for assets deemed surplus to current needs and, in many cases, to pay down debt or make strategic acquisitions in their core business. These forest products companies often enter into supply agreements with the new owners of the timberland to provide a stable source of timber for their mills.

For East Texas forestry, there are downsides associated with forest industry land sales. Forest products companies that sold their land no longer employ field staff or own fire suppression equipment previously used to aid state fire crews to suppress forest fires. In many cases, forest products companies provided larger equipment than was normally part of state resources. Since the new owners outsource their reforestation, site preparation and roadwork to private vendors, they do not have the staff or equipment resources of the former owners for fire response. Finding a solution to this situation is critical; otherwise, fire losses could become excessive and drive away potential investors who are critical to the long-term future of the forest-based economy.

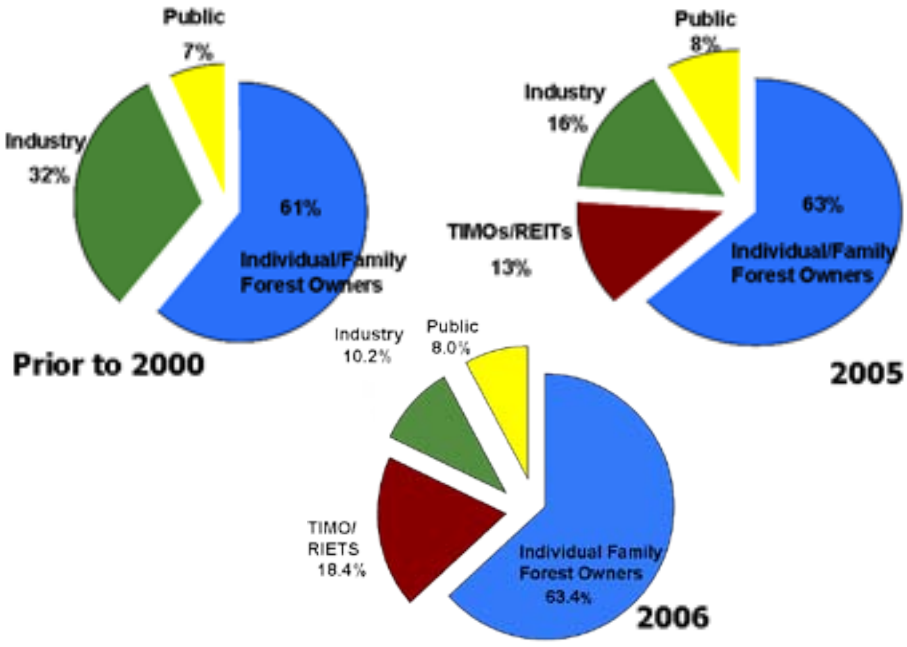
The large-acre land sales may also provide uncertainty to the long-range timber supply, given the new owners' relatively short-term (10 to 15 years) investment horizon and the question of long-term commitment to intensive timber production and stability. The former timber companies had a long history of sound timber management, and the current surplus in timber supply in Southeast Texas is largely a result of their large investment in reforestation and other growth enhancement practices. Another long-term timber supply concern is fragmentation — land being split into smaller tracts and sold to real estate speculators. In addition, conservation interests have purchased properties with high environmental values, such as the 33,000-acre Middle Neches River tract.

There are concerns about the impact of loss of corporate support for agency/industry cooperative research programs. These arrangements may not fit as well with the new owners due to their more limited size and complexities. For example, the Western Gulf Cooperative Tree Improvement Program was designed for members to share the cost of tree breeding. It works if the membership is sufficient to lower costs and make workload manageable for the members. Membership decline can place a strain on such a cooperative.

This is a big change for East Texas, given industry ownership was stable from 1964 through 2002. Since the early 1990s, forest industry invested an estimated $425 million to boost timber production. Higher timber yields and shorter rotations were central to forest planners' long-term expectations. This resulted in a 23.5 percent gain in softwood growth on these lands between 1992 and 2003. Forest industry transformed from harvest exceeding annual growth by 20 percent in 1992, to a more than sustainable harvest of 93 percent of growth over the subsequent 10 years.

About one-third of the industry land sold in 2002 went to short-term owners; in some cases, the land was resold in a matter of months. These new owners likely may not practice the high intensity timber management of the former owners, which could result in lower growth in the future. It could be some time before this ownership (Figure 2) stabilizes and the impact on future timber supplies is known with certainty.

Figure 2. Ownership patterns prior to 2002 versus after



On the other hand, some forest industry land sales could be beneficial to potential Texas manufacturers by increasing timber supply. For example, in 2004, Boise Cascade sold a large paper mill, lumber and plywood plants, engineered wood plants and 650,000 acres of timberland in southwestern Louisiana. Most likely, the sale included some continuing timber commitments to the former company mills, but it could also make available surplus timber that could have important implications for economic development in Southeast Texas. The ability to secure timber supply agreements with large forest landowners, such as those by International Paper in 2006 land sales, is critical to attracting large manufacturers that do not have a land base in Texas.

Family Forest Landowner Profile

There are an estimated 170,000 owners of tracts of less than 50 acres of forest land in East Texas. Collectively, this group owns nearly 2 million acres. While many of these tracts are too small for commercial timber production to be practical, some of these tracts are close enough to other family forest owner holdings to make enough land in total to be cooperatively managed. This land is 17 percent of the total commercial forest land, an indicator of the extent of fragmentation in East Texas. Another 28,000 family forest owners each have 50-499 acres, for a total of 4.5 million acres. This ownership is 70 percent of the family forests in East Texas and represents the biggest opportunity for increasing timber production. Timber production is not these owners' primary means of support – they own enough land that economic return is important – but may not have the means or desire to make sizeable capital commitments where the return is 30 to 40 years later. Forty-four percent of these owners are over 65 years in age, and 74 percent are over 55. Primary purposes of ownership were legacy, part of home or farm, land investment, aesthetics, nature protection and timber production (Butler, 2004).

Forest Fragmentation

Forests are being parceled and populated at a rate far faster than any recent period. In the past, most concerns about urbanization were in the Northeast, Pacific Southwest, South Florida, Arizona and parts of Texas, which had little impact on forests. More recently, urban growth is taking a toll on important

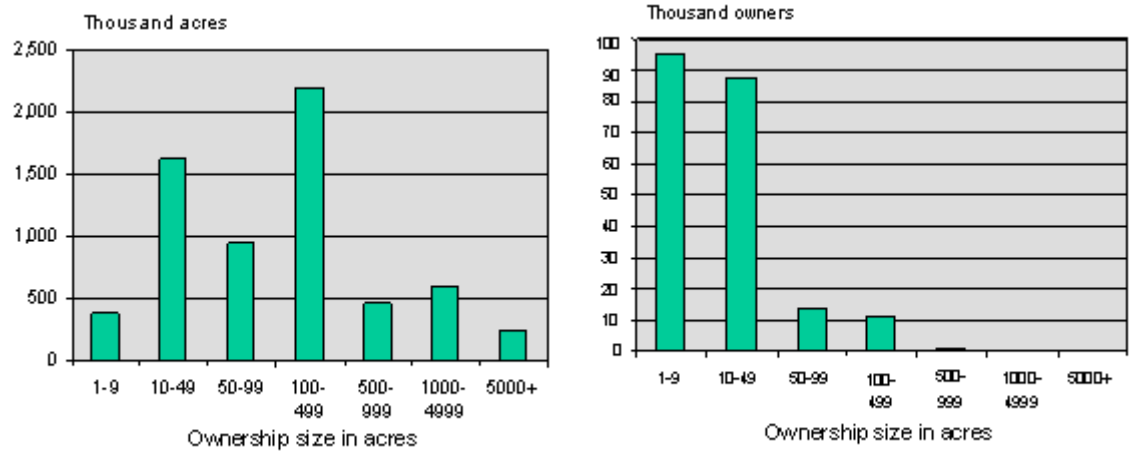
timber-producing areas of the South, including Virginia, North Carolina, North Georgia, Southeast Texas and parts of Tennessee. In its most recent forest inventory, North Carolina reported losing more than a million acres of forest land to development. While the South is the "timber basket" of the nation, very few southern states are escaping the loss of prime forest land to development.

Loss of green space to development is the driving force behind the increase in non-profit land trusts, which purchase conservation easements for the permanent development rights to a property. This is a relatively new vehicle for landowners to capture the value of real estate development yet retain private ownership and use of their land in perpetuity for producing timber, livestock or agriculture crops. The Forest Legacy Program (FLP) is a voluntary, federal cost-share program that supports the protection of economic and environmentally important forest lands threatened by conversion to non-forest uses. This collaborative effort between USDA and state agencies encourages cooperation between local governments, land trusts, conservation organizations and private landowners to take a team approach in addressing the rapid rate of forest fragmentation. Texas entered into the FLP in 2004.

In the 1970s, Montgomery County and northern Harris County were important timber-producing areas. Today these areas are highly urbanized with soaring land values. Real estate presently along Farm to Market Road 1488 is valued at $40,000 or more per acre if suitable for development. Taxable property value in Montgomery County in 2003 was over $21 billion, most of which was residential property value, according to the Texas Comptroller of Public Accounts. That amount is more than the combined property value of sixteen of the largest forested counties in East Texas!

Expected population growth in Texas will require large amounts of land for residential, commercial and industrial development, as well as transportation, utilities and water reservoirs. Fragmentation includes dividing large tracts into smaller parcels. It also includes inherited lands, where each successive generation leaves each owner with a smaller parcel of land. Texas has approximately 95,000 owners with 380,000 acres in the category of 1 to 9 acres — an average tract size of 4 acres (Figure 3). The next larger category, 10 to 49 acres, has approximately 88,000 owners with 1.6 million acres and has an average tract size of 18 acres. In general, when tract size drops below 20 acres, owners have a difficult time marketing timber and finding contractors to implement reforestation at affordable prices.

Figure 3. Area and number of family-owned forests in Texas, 2003



Source: Brett Butler, USDA Forest Service

Fragmenting forests into isolated pieces through development destroys wildlife habitat. Conservation groups are working to protect critical habitats in threatened areas, to secure habitat for migratory birds in the coastal prairies and forests, and to protect red-cockaded woodpecker habitat north of Houston in and around the national forests. Fragmentation is one of the most important issues policy makers in Texas could address to ensure the sustainability of the forest-based economy and associated ecosystems.

Forest Types

Change in acres by forest type is significant, given productivity differences among types. About 80 percent of the forests in East Texas are suitable for pine production. Pine forests include natural pine stands and pine plantations. In both cases, pine forests can have a hardwood component up to 25 percent of total stocking and still be considered pine type. Lands primarily stocked with pine are more productive than mixed pine-hardwood and certainly more than upland hardwood types. Bottomland forests or forested wetlands are the most productive hardwood forests. Because of their economic value, these resources are vital to the local economy and contribute to the tax base for local government and schools.

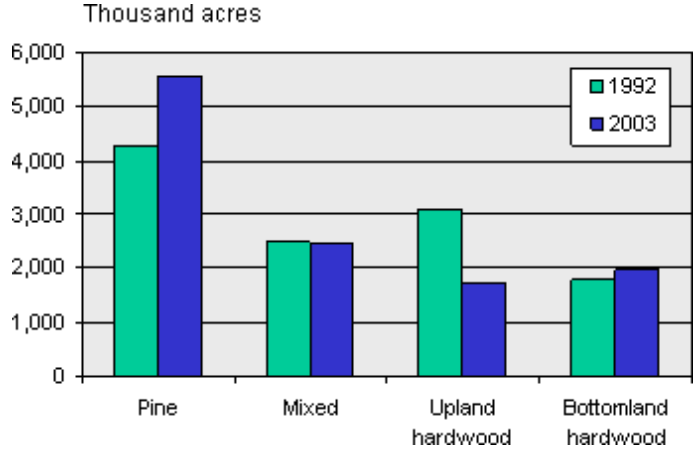
From 1992 to 2003, acreage in pine forests increased by 30 percent to 5.6 million acres, with just over half of these acres planted pine. Mixed pine-hardwood dropped one percent to 2.4 million acres, upland hardwood dropped 45 percent to 1.8 million acres and bottomland hardwood acreage increased 10 percent to 2.0 million acres (Figure 4). The large drop in upland hardwood, which is often composed of high-graded, mixed stands that need to be regenerated, shows that landowners are making substantial capital investments in site preparation and planting to improve overall forest productivity. The increase in bottomland forests is likely from the reversion of agricultural lands on wetland sites back to forest land. This is positive for the hardwood forest industry and for wildlife habitat and watershed protection.

Timber Markets

Texas Trends

The forest-based industry in East Texas can be divided into three categories: **building products**, **paper and paperboard** and **hardwood lumber**. **Building products** consist of pine lumber and structural panel, including oriented strand board (OSB) and plywood. Sawmills in East Texas increased output 8 percent in 2004, to 1.9 billion board feet (bbf). Structural panel production increased 5 percent in 2004, to

Figure 4. Area of timberland by forest type in East Texas 1993 vs. 2003



2.86 billion square feet (bsf), compared to an 3 percent decrease in 2003.

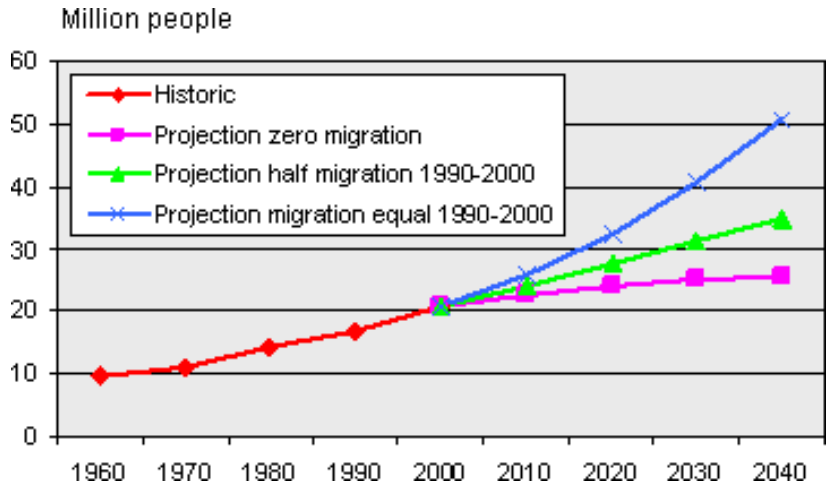
Paper and paperboard production increased 6 percent in 2004, to 2.56 or million tons. There was no market pulp produced in Texas in 2004, nor was there any paper production as the idling of the last paper mill in Texas occurred in 2003. The newsprint mill at Sheldon, which used only recycled paper, has been idle since 2002. In December 2003, the newsprint mill at Lufkin was indefinitely idled and the previously-idled paper machine at Sheldon was permanently closed. Of the major wood-using industries in Texas, paper mills have struggled from the economic recession, foreign competition, aging equipment and increased energy prices. However, encouraging comments have been made that both the Lufkin paper mill owned by Abitibi, Inc. and the Orange paper mill, owned by Temple-Inland Inc., would possibly receive major upgrades in the future. Both mills have favorable locations for wood supply. The Abitibi mill has recently installed a new paper machine and other upgrades, and the owners have suggested if reopened the mill would likely be converted to a more value-added product. In addition, the mill is converting their boiler from natural gas to alternative fuels such as woody biomass.

Hardwood lumber production increased 89 percent since 1993, rising from 172 million board feet to 324.7 million board feet in 2004. Strong markets for railroad ties, grade lumber, pallet stock and flooring are driving the increase. According to the Wood Flooring Manufacturer's Association, solid hardwood strip and laminated flooring demand in the U.S. has risen ten-fold since 1985. Unfortunately, much of the better quality hardwood logs and lumber produced in Texas are being exported to value-added facilities in other states or sawn into lower-valued products in Texas' older and less efficient mills. Texas also lacks capacity to dry and finish rough-sawn, green (wet) grade lumber into the finished products needed by cabinet, millwork, flooring and furniture makers. This results in a lower market value for Texas timber resources and the export of economic opportunity to neighboring states.

Texas Forest Service conducted a study of lumber and structural panels purchased by retailers in Texas in 1998. In 1994, 50 percent of the lumber consumed in Texas was produced in Texas mills. By 1998, only 37 percent of the lumber consumed in Texas was produced in Texas. About a quarter came from other southern states, 22 percent from foreign imports (mainly Canada) and the remaining 16 percent from western states.

Texas mills supplied 62 percent of the panel products consumed in Texas in 1998. Other states produced 27 percent, and 11 percent

Figure 5. Texas population projections



was imported from western states and other countries. Recently, Brazil has become a significant new source of imported panel products.

Texas appears to have positive market opportunities given population growth projections easily increasing 12 million over the next 20 years (Figure 5). The South is the only region in the U.S. where timber supplies are expected to increase over the next two decades, assuming leaders in the forestry community at all levels continue to develop a common vision and financial commitment to build a forest resource base sufficient to meet future needs.

Global Trends

The forest-based economy of Texas and the nation is facing the new paradigm of major global competition in the market place. Major technological breakthroughs have included making newsprint and plywood from southern pine, OSB from wood flakes and computer-driven optimization systems that enable manufacturers of lumber to significantly increase production with less labor and lower wood cost. The current global market situation is largely the result of two events: the opening of China to capitalism, foreign investments and trade, and the collapse of the former Soviet Union. In both cases, huge amounts of human and natural resources are being unleashed to world markets.

Ten countries joined the European Union (E.U.) in May 2004, increasing its membership from 15 to 25 nations and its population by 20 percent to 447 million. This will produce a larger internal market and encourage trade in conjunction with general economic improvement and rising standards of living. The new E.U. countries boast about 57 million acres of forest land, boosting the E.U.'s forests available for wood supply by 25 percent (UNECE/FAO, 2004).

Substantial positive change has taken place in the forestry sector of Russia. During the transition period since the collapse of the Soviet Union, the forest industry has almost completely privatized. However, forest and round wood production remain under state control. In 2004, the Ministry of Economic Development established a target to expand the forest sector from $10 billion in 2003, to $100 billion by 2025 (UNECE/FAO, 2004). In many of the Central and Eastern European countries with economies in transition, the ownership pattern is undergoing substantial change as land is restituted to former owners or privatized.

The timber resources of Russia, owners of the largest softwood inventory in the world, are now feeding new paper mills and wood product plants in Central and Eastern Europe, Japan and China. China is now second to the U.S. in the size of its forest-based industry. China's gross domestic product has grown by an average of 9.5 percent per year, three times the rate in the U.S. The industry of old economy regions of North America and Western Europe now share markets with these new producers that have access to low cost timber and labor and have plants with the latest technology. Like any developing economy, the new producers need established forest product markets like those in the U.S. and Western Europe. This new capacity is putting pressure on U.S. corporations to reassess long-established manufacturing and marketing strategies. In the long run, emerging economies should become larger consumers and help create a bigger market for all.

World timber demand is expected to increase greatly over the next twenty years. In 2004, many economies of the world were still struggling to come out of recession. There is excess timber supply in parts of Europe and Asia; however, this should change over the long term. Some timber being used in countries with emerging economies comes from countries where illegal harvests are common. Industrial world timber supply is forecast to be only 77 percent of demand by 2020 (Sutton, 1999).

Growth and Removals

Softwood Growing Stock

Northeast Texas

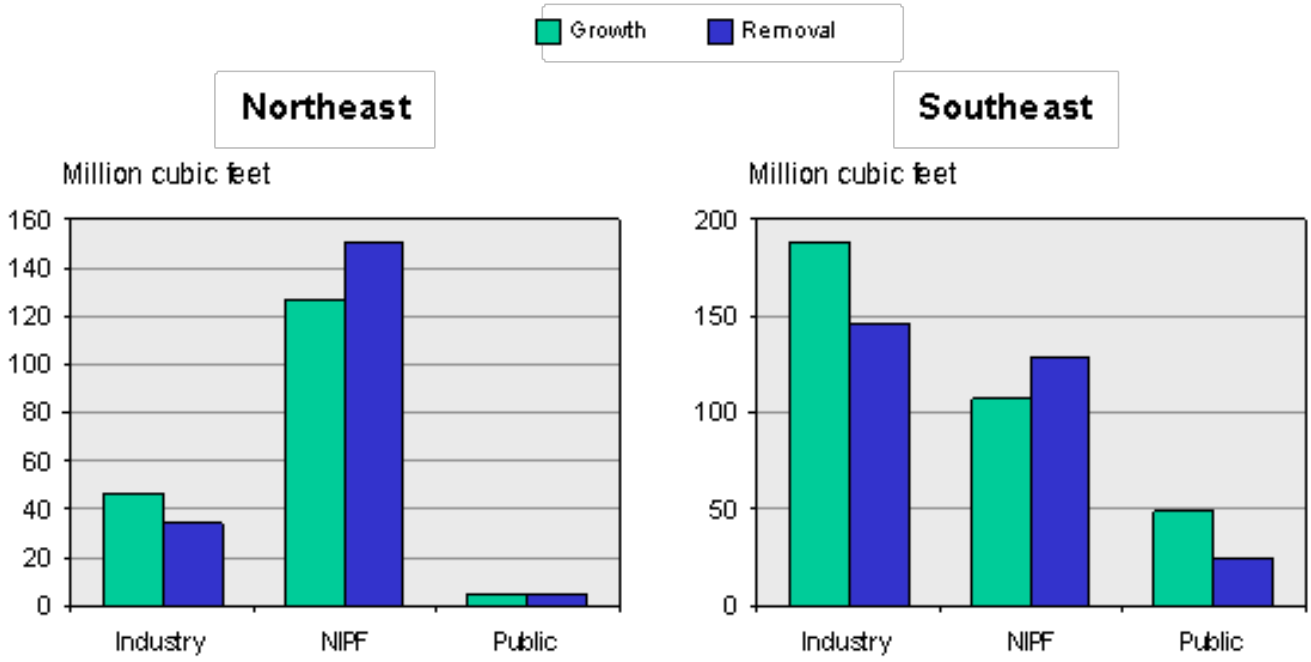
In Northeast Texas, family-owned forests dominate the ownership and thus the bulk of timber resources. Seventy-one percent of the 175.9 million cubic feet of annual production comes from family-owned forests (Figure 6). Forest industry has most of the balance at 26 percent of the total annual softwood growth, with only three percent on public lands. Across all categories of ownership in Northeast Texas, removals exceed growth by almost six percent. Most of the deficit is on family forest land where harvest has exceeded growth by 18 percent annually since 1992.

Southeast Texas

In Southeast Texas, forest industry and family forests are substantial timber producers, and overall production is almost twice as much as in Northeast Texas. The most striking similarity is the growth and removal picture for family forests, where removals exceeded growth by about 20 percent in Southeast Texas. Industry has a surplus in this region of 35.8 million cubic feet. Public forests make up 14 percent of the annual softwood timber production; however, they only contribute 7 percent of the total harvest. Removals on public lands are less than half of annual growth, a trend not expected to change.

About 80 percent of growth on forest industry land occurs in Southeast Texas, where the uncertainty associated with land sales exists. Southeast Texas also offers the most promising prospects for industry expansion. There may be limited development opportunities associated with the industry lands in Northeast Texas, given its surplus growth, but opportunities will largely depend on family forestlands since harvest exceeds growth by such a wide margin.

Figure 6. Texas softwood growth and removals by region, 2003



Forest Sustainability

Texas

Possibly the most significant finding of the 2003 forest inventory is the shortfall in softwood annual growth versus removals on family forest lands. Between 1992 and 2003, annual removals exceeded growth by 20 percent. This is a significant deficit given that the family forest ownership is the largest category in East Texas, with 63 percent of the forest land and 57 percent the total harvest. The forest-based economy cannot sustain a continuation of the trend without adversely impacting industry capacity. The surge in timber growth on industry lands, mostly in Southeast Texas, compensated for the family forest owner deficit and has created a surplus of timber growth for the region. Surplus softwood growth from public lands — largely the National Forests of Texas — is not fully available, as only about half its annual growth is currently being harvested.

Pine sawtimber removals from family forests in East Texas exceeded growth during the period of 1992 to 2003 by 17 percent annually. On industry land, softwood sawtimber removals were more than sustainable at 78 percent of annual growth. When considering resource sustainability, future growth from existing growing stock, currently too small to be counted in the forest inventory as growing stock, must be considered. For softwoods, there are 23.6 million green tons in the pipeline classified as sapling-size trees (1-inch to 4.9-inch diameter), which over the next decade will reach merchantable size.

Another measure of sustainability is the ratio of annual removals to inventory. The East Texas ratio of inventory of growing stock to removals of growing stock — trees over five inches in diameter at breast height (4.5 feet above ground) — in 2003 was 18:1, meaning there has been eighteen times as much standing inventory as average annual removal since 1992. To give this improvement a historic perspective, in the 1992 inventory, this ratio was 15:1.

The softwood growth to removal ratio imbalance by owner group has been evolving over time. Forest industry has been adjusting to a tight timber supply situation since the early 1990s. Industrial removals were at or above annual growth for almost thirty years, as evidenced by the 1975 through 1992 inventories (Figure 7). Growth on industry lands from 1992 to 2003 years has surged ahead of removals as a result of substantial capital investments in reforestation. This is important because it shows that a large inventory base will respond in a relatively short period of time with the right investment.

These trends also show that removals can change dramatically in relatively short periods of time. There was a huge increase in removals among all owners from 1965 to 1985, then a major pull-back on industrial lands to a more sustainable level for the next twenty years. The removal trend on family forests has been rising since the 1965 inventory. There was a major boost in growth between 1965 and 1975, which was largely due to reduced pressure from removals and to the Soil Bank Program, a federal land rent program to encourage farmers to take marginal cropland out of production. The

Figure 7. Forest industry – softwood growth and removals, 1965-2003

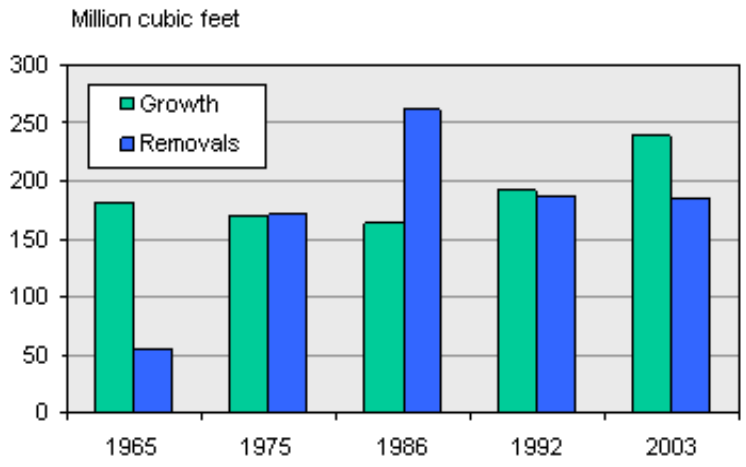
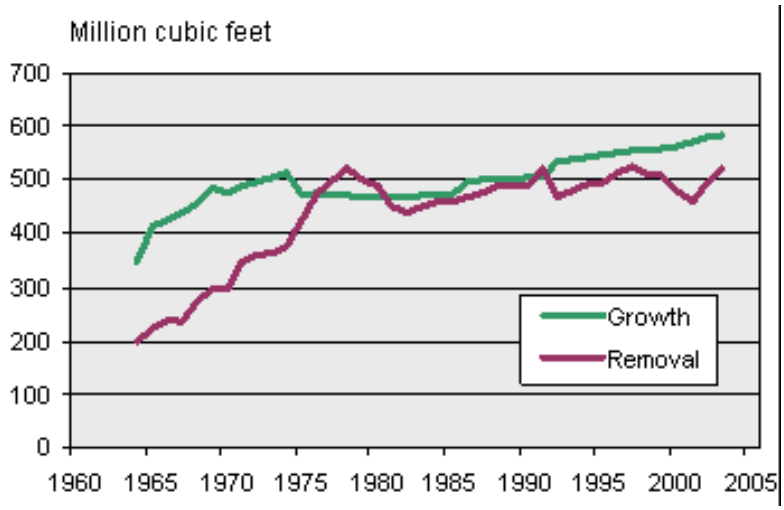


Figure 8. Softwood growth and removals in East Texas, 1964-2003



growth curve changed very little between the 1975 and 1992 inventories; however, removals rose steadily for the entire period. The current inventory shows a significant drop in annual growth on family forests. Continued annual timber removal in excess of annual growth is beginning to deplete the resource. The removal trend for all ownerships was about even with growth for most years between 1983 and 1992 (Figure 8). Discounting the unavailable surplus growth on public lands creates a deficit situation.

The large inventory in Northeast Texas is masking a serious timber supply situation, with over-cutting occurring while mills are still able to get all the timber they need without a great deal of pricing pressure. A large timber inventory provides both stability against short-term, market-driven fluctuations and long-term sustainability for the industry base. Currently, due to the sizeable inventory, there is sufficient time to deal with the developing timber supply shortfall in East Texas. The forestry community and policy makers need to develop and fund programs now to expand the timber base to restore sustainability and meet future needs. This will send a positive message to forest industry and other concerned parties that want to insure that capital will continue to flow here for mill improvements and new mill capacity. To give some perspective relative to the lead time necessary to deal with timber supply issues, it takes at least twelve years for trees to reach minimum size requirements for pulp and paper and OSB mills.

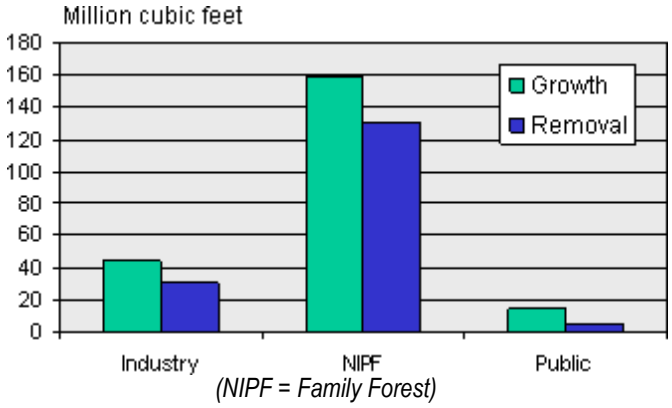
South

In 1994, southern forest economists made an assessment of the collective ability of the southern states to meet expected future timber needs. Based on FIA data at the time, they determined that the core 10 states that housed the bulk of the industry were already over-cutting the softwood resources. Only when the fringe states and sub-state units were included did growth exceed the annual removals. Economists concluded that sustaining long-term timber inventories and harvest increases in the South would be extremely difficult in the areas where wood is needed most. In areas where industry is concentrated, fiber supplies are inadequate to support much increase in removals (Cubbage, et al., 1994). Since then, a major economic recession occurred with a shakeout in the industry that produced fewer mills, more global players and a better balance of mill capacity with demand. However, as part of this reshaping of industry, a major part of the better-managed industry lands have been sold to TIMOs with no track record to gauge how effective they will be in the long term as timber growers. A portion of this forest land has moved into the hands of real estate speculators. The situation in East Texas and much of the South is similar, and without significant infusions of capital for reforestation, there will be limited opportunities for growth in the forest-based economy.

Hardwood Growing Stock

Hardwood growing-stock removals are only 82 percent of growth in East Texas across all ownerships. Seventy-two percent of total growth is on family-owned forestland (Figure 9). Hardwood sawtimber removals are only 64 percent of growth, much lower than for hardwoods as a whole. Hard hardwoods — largely oak, ash, and hickory — contribute 66 percent of hardwood growth. Annual mortality is high in hardwoods at 62.1 million cubic feet, compared to 210.9 million cubic feet of net annual growth of growing stock.

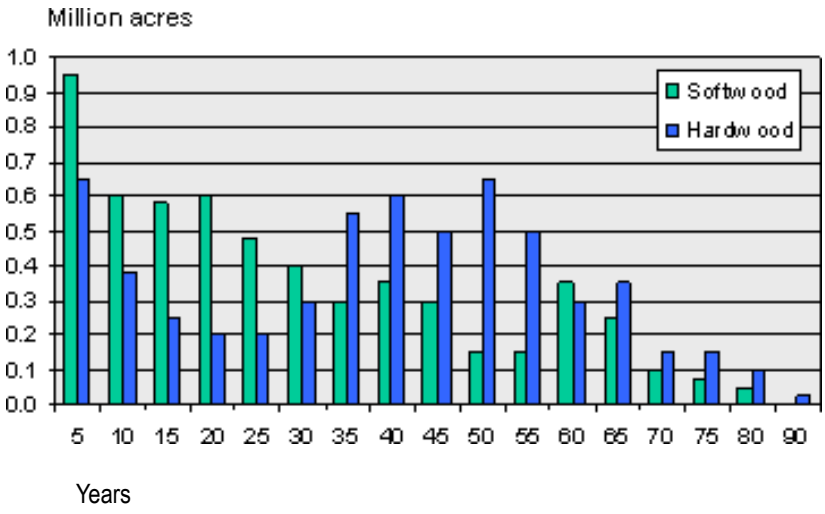
Figure 9. Texas hardwood growth and removals by ownership class, 2003



Given the amount of hardwood timber contained in streamside management zones with voluntary cutting restrictions, availability of the 37.8 million cubic feet of net annual hardwood surplus is in question. Another measure of resource sustainability is the ratio of inventory to removals of growing stock trees. The ratio for hardwoods was 38:1 in 2003, while the 1992 inventory showed a ratio of 32:1. Across the South for the same period, the ratio was 49:1, meaning Texas' hardwood resource has improved relatively, but not as strong as the Southern average. Texas not only has a surplus in annual hardwood growth, but also a significant inventory to buffer removals while correcting dips in acreage by age class (Figure 10). This is important from an environmental perspective as the industry is able to restrict harvesting in streamside management zones with little impact on supply. For the first time in Texas, economic incentives of the market place are swinging in favor of hardwoods, providing a powerful motivation for private landowners to allocate more land and resources to hardwood management.

There is good distribution of acreage in most age classes important to production. Generally, hardwood trees produce better lumber and veneer of higher quality with age up to a point, after which the trees begin to decline and decay. There is a good balance of trees in the over-forty age classes but not much over the 65-year age class, which is favorable to production. There is significant acreage in younger trees, which is vital to sustaining the resource. The dip in acreage in the 15- to 35-year age classes indicates growth is not sufficient to support the current level of cutting for pulpwood-size material. Reducing harvest volumes of hardwood pulpwood and focusing more on management of sawtimber production will yield higher values.

Figure 10. Stand age of softwood and hardwood forest types, East Texas timberland, 2003



Texas Forest Productivity and Health

Mortality

Average annual mortality of growing stock in East Texas from 1992 to 2003 was 65.4 million cubic feet for softwoods, compared to 55.5 million cubic feet per year from 1986 to 1991. Hardwood average annual mortality was 62.1 million cubic feet from 1992 to 2003 compared to 40.3 million cubic feet per year during the previous inventory period. The combined annual loss of growing stock for all species is equivalent to 1.6 million cords. When valued at $15 per cord, this represents a loss of $24 million per year. These losses were driven by the droughts during the period from 1996 to 2000, the worst drought cycle in the last fifty years, as well as a severe ice storm in Northeast Texas in 2000.

Drought and Ice Storms

The worst multi-year drought since the 1950s caused Texas Forest Service to bring in federal and state firefighters and equipment from across the nation to assist with the huge fire workload in the summer of 2000. Texas Forest Service spent $64 million on fire suppression during that fire season. The ice storm of 2000 significantly impacted forests in Red River, Bowie and parts of Cass Counties. Especially hard hit were pulpwood-sized industrial plantations that had been thinned (Figure 11).

Figure 11. Ice storm damage

Approximately 9,000 acres of the affected family forests were reforested with federal and state assistance. Losses in urban forests were heavy. Technical and financial assistance was provided to help with disposal of tree debris and urban tree replanting. Extra fire protection measures were implemented with federal and state assistance in response to the heavy fuel buildup resulting from the ice-damaged trees.

Insects and Diseases

Pine regeneration pests are the focus of the Western Gulf Forest Pest Management Cooperative, a public/private research effort led by Texas Forest Service entomologists. The Cooperative, initiated in 1996, develops integrated pest management technologies that help minimize pest-caused losses. The Cooperative is conducting research on seed and cone insects and reforestation pests including weevils, pine tip moths and leaf-cutting ants.

Infestations of the southern pine beetle (SPB) — the most important insect pest in southern pine forests — have been low to non-existent in East Texas since 1997. East Texas experienced almost continuous outbreaks from 1958 through 1978. After a brief lull from 1979 to 1981, SPB activity increased in the middle 1980s to record levels in 1985, especially on the National Forests in Texas. From 1990–1993, large SPB infestations devastated mature pine forests on several recently-designated federal wilderness areas in East Texas due to the lack of control. SPB activity was severe in the Southeastern states during 2000 to 2002, from Maryland to Mississippi and through eastern Tennessee and Kentucky. The best defense against SPB is to maintain a healthy, properly-managed forest. A cooperative federal/state prevention project is rating East Texas forests for potential SPB activity and providing cost-share assistance to encourage Texas landowners to thin high hazard stands.

A result of increased global trade, imported pest organisms (insects, diseases, plants, etc.) are a growing threat to forests across the nation. One of the most abundant of these non-native, invasive pests is Chinese

tallow (*Sapium sebiferum*), an imported ornamental tree that now infests 53,000 acres of commercial forest land in East Texas in an area extending from Lufkin to Houston.

Sudden Oak Death (SOD), a tree disease caused by *Phytophthora ramorum*, was first detected in California in 1995, and the fungus was unknowingly sent to 11 states in 2004 via infected nursery stock. The fungus has been identified from 10 Texas nurseries that received infected plants. The USDA Animal and Plant Health Inspection Service is working with Texas Forest Service and Texas A&M University to monitor these sites to ensure the disease does not escape. To date, surveys of forested areas adjacent to infected nurseries have found no signs of the disease. This is a very potent disease that could threaten many of the oak species in Texas, and its occurrence has caused a major alarm throughout the eastern part of the nation.

Giant Asian dodder (*Cuscuta japonica* Choisy), a rapidly spreading plant, was detected in Houston in 2002, and several infection sites were controlled through a multi-agency effort. It appears to be contained, but new infestations are expected to be a problem.

Hurricane Rita

Hurricane Rita made landfall on September 24, 2005, on the extreme southwest coast of Louisiana between Sabine Pass and Johnson's Bayou. The storm made its way up through East Texas into Northeast Texas, then through the Mississippi Valley. Damage from the storm stretched from East and Southeast Texas to Southeast Louisiana, with the worse damage sustained in Orange, Jasper, and Newton counties in Texas.

Texas Forest Service estimated the total value of timber impacted in Texas at $833 million. Total volume of timber damaged and affected was 967 million cubic feet, or about 6 percent of the total volume of East Texas growing stock.

A mill survey in May 2006, conducted by Texas Forest Service, showed that 1.2 million tons of timber had been salvaged, with much more expected over the next six months from hardwood acres and USFS lands.

Forest Legacy

The Forest Legacy Program (FLP) is a voluntary, federal cost-share (25 percent private to 75 percent federal match) program intended to support the protection of economic and environmentally important forest lands threatened by conversion to non-forest uses. The program focuses on the acquisition of partial interest in private forest lands through working forest conservation easements. The program encourages collaboration among local governments, land trusts and conservation organizations to assist private landowners in capturing the value of real estate development while retaining private ownership of the property and the use of their land in perpetuity for producing timber, livestock or agriculture crops.

Texas Governor Rick Perry petitioned the U.S. Forest Service in 2003 to be included in the Forest Legacy Program and at the same time designated Texas Forest Service as the lead agency to administer the program. The U.S. Department of Agriculture accepted the entrance of Texas into the program in 2004. Fifty-nine East Texas counties — 30 million acres — are included in this program.

Texas Forest Service, which is responsible for enforcing the easements, receives federal program funds to administer this program and ultimately holds title to the easements. Projects are selected on a competitive basis for federal funding by the USDA Forest Service in Washington, D.C.

The Texas Forest Legacy Committee (TFLC), a sub-committee of the Texas Forest State Stewardship Coordinating Committee, has

identified four overall goals for the program in Texas. They are to:

- support Texas rural communities, traditional land uses and cultural heritage by maintaining large privately-owned, working forest landscapes managed according to sustainable best management practices
- promote conservation of biological diversity by protecting habitat connectivity, unique ecosystems and endangered species
- promote watershed protection to enhance water quality and quantity, and to protect aquatic habitats
- support open space initiatives to decrease forest fragmentation, protect unique habitats or ecological features and reduce negative effects of urban sprawl.

Projects may be submitted to Texas Forest Service each year from January until August 31 for the following federal fiscal year. Projects will be prioritized by the TFLC according to the degree that the land is threatened, forest resource economic benefits, public benefits, water quality and watershed protection, ecological or cultural benefits, proof of readiness and likelihood of completion, and strategic initiative.

Texas was awarded $493,000 from FY05 Congressional funds to assist in the placement of a Working Forest Conservation Easement on land submitted as a project near Tyler. Texas Forest Service received $25,000 to administer the program.

Reforestation

Between 1992 and 2004, approximately 550,000 acres were planted in East Texas. Of this, approximately 205,000 (37 percent) received cost-share assistance and (likely) publicly-funded technical assistance. The average cost-share funding provided was $46.68 per acre. Over this period, these landowners expended roughly $148 million, based on present costs, for site preparation, seedlings, planting, herbicides and technical assistance.

Cost-share Programs

Historically, the two primary cost-share programs were the federal Forestry Incentive Program (FIP) and the private Texas Reforestation Foundation (TRe). FIP began in 1975 and ended in 2002. Over FIP's 27-year history, Texas landowners received $12.9 million in cost-share funds and planted 276,462 acres. In a typical year, Texas received approximately $550,000 in FIP cost-share funds and planted 11,800 acres. Table 1 shows the Cost-share programs and acres planted *(NPF = family forests)*.

Figure 12. Historical reforestation in East Texas

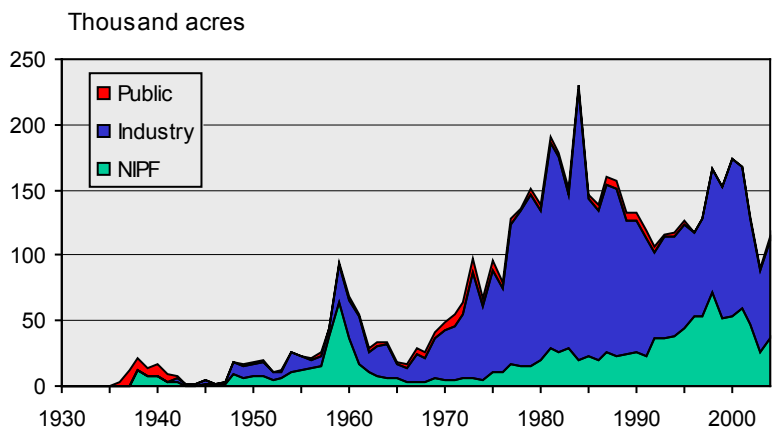


Table 1. Reforestation Cost-Share Programs and Acres Planted

Year	All Programs	FIP	ISRP	EQUIP	CRP	FLEP	TRe	SIP
2004	11,441	0	3,627	3,868	20	1,835	2,091	0
1999	23,319	9,328	-	299	1,530	-	11,628	534
1994	31,252	15,083	-	817	177	-	11,078	4,097

TRe, established in 1980, is funded with voluntary contributions from forest industry. According to the Texas Forestry Association, TRe has provided nearly $8.5 million since its inception in cost-share assistance to private landowners to plant 186,805 acres. TRe was established to help bridge the gap in demand for cost-share assistance not being met by FIP. Charter members of TRe included Temple-Inland, Southland Paper Mills, Champion Paper Corporation, International Paper Company, Owens Illinois, Walker Brothers Lumber and Dean Lumber Company. In a typical year, TRe provided roughly $450,000 in financial assistance to landowners to plant 9,900 acres. Figure 12 shows the historic reforestation levels for forest owners.

Other federal cost-share programs have included one million dollars to assist landowners with recovery efforts resulting from the previously-mentioned 2000 ice storm in Northeast Texas that reforested an estimated 9,000 acres. The Stewardship Incentive Program (SIP), the Environmental Quality Incentives Program (EQIP) and the Forest Land Enhancement Program (FLEP) have collectively reforested 21,995 acres through 2004.

The peak year for cost-share programs was 1994, when 31,252 acres were planted. In 2000, TRe funding began to decline, and planting dropped nearly in half to 5,400 acres. Funding and planting continued to decline with only 2,091 acres planted in 2004. The Forestry Incentives Program (FIP) was last funded in 2002, when it provided funding for planting only 8,187 acres. FLEP, which was a replacement for FIP and SIP, was not funded in 2004, and its future is questionable. EQIP has designated funding for control of the exotic pest Chinese tallow and for establishing longleaf pine (*Pinus palustris*). In 2004, this program funded planting 3,887 acres, compared to an average of less than 550 acres per year in the preceding six years.

Tax Incentives

Other forestry incentives in Texas include sales tax exemptions and property tax reductions, which include **Timber Productivity Valuation, Timber in Transition and reforested land**. Beginning October 1, 2001, Texas law allowed phased-in sales tax exemptions on purchases of tree seedlings, silvicultural chemicals and equipment for use in timber production. After January 1, 2008, full exemption of sales tax on these items will take effect.

Timber Productivity Valuation is a reduced appraisal based on the land's capacity to produce a crop, as compared to Full Market Valuation for property tax. In 2004, the State Comptroller reported average Full Market Value for timberland at $950 per acre versus $246 per acre for the Timber Productivity Valuation. There were 7.7 million acres enrolled in the Timber Productivity Valuation in 2004.

Timber in Transition allows the owner to retain the much lower Agricultural Use Valuation for the first fifteen years following the planting of trees on former agriculture lands. Statewide average appraised value for agricultural land was $68 per acre in 2004.

Reforested land incentives include reducing the timber productivity value by 50 percent for the first 10 years following harvest, resulting in a tax savings of approximately $3 per acre per year at 2004 tax rates.

Benefits of Texas Forests

Economic Impact

Texas Forest Service conducted a study to determine the forest sector's direct and total impacts to the overall Texas economy in 1999 in terms of total industry output, value-added processes, employment and labor income. Economic activities in the forest sector have three kinds of effects on the overall economy. Direct effects are the sector's own production, value-added processes, employment and labor incomes. Indirect effects are the economic activities in other sectors impacted by the forest sector's purchase of goods and services. Induced effects are economic activities from the consumption of goods and services using incomes generated from direct and indirect effects. While direct economic impact of a sector includes only direct effects, total economic impact includes all three effects generated by the forest sector. The Texas Forest Service study utilized the IMPLAN System, which is an input-output model that estimates impacts of the sector of interest to the regional economy by using the relationships among sectors and deriving multipliers for output, value-added processes, employment and labor income of the sector. Multipliers capture the total economic impact of economic sectors including direct, indirect and induced effects.

Statewide

The forest-based economy in 1999 produced $12.9 billion of direct economic impact in Texas, of which $4.6 billion was value-added. The difference between value-added impact and output is the intermediate inputs, such as raw materials and energy. The forest sector had the highest ratio of value-added impact to output — 57 percent — followed by logging at 42.5 percent. The sector employed 79,500 workers and paid $2.9 billion in wages, salaries and benefits. Of the six sectors included in the analysis, the largest output came from the secondary paper and paperboard industry, followed by the secondary solid wood products industry. The output to employment ratio, a labor productivity index which measures annual output per employee, was highest for the primary paper and paperboard industry at $384,200 per employee. Logging was second at $167,900, and forestry was third at $160,100.

Total economic impact of the forest sector in Texas was $22.1 billion including $9.9 billion of value-added impact. The forest sector created 169,200 jobs and generated $6.0 billion in labor income.

East Texas

Direct economic impact of the forest sector in 1999 in East Texas was $6.1 billion for goods and services. The sector generated $2.2 billion in value-added impact, created 32,660 jobs and produced $1.2 billion in labor income. East Texas accounted for 89 percent of all primary solid wood manufacturing and 82 percent of primary paper and paperboard manufacturing. On the other hand, most of the secondary manufacturing of both industries is located outside of East Texas. Of all the forest industries in East Texas, primary paper and paperboard manufacturing was the number one producer with the largest output, value-added impact and labor income. Primary solid wood product was second in all four categories of economic indicators.

Table 2 shows the total economic impact of the East Texas forest sector was $10.9 billion of output of goods and services in 1999. This included a value-added impact of $4.9 billion and $2.9 billion of labor income for 77,300 jobs.

Table 2. Total Economic Impacts of the Forest Sector in Texas, 1999

Sector	Industrial Output Million dollars	Employment Jobs
Forestry	900.0	9,576
Logging	748.2	5,581
Primary Solid Wood Product	3,430.6	24,712
Secondary Solid Wood Product	6,553.9	66,827
Primary Paper and Paper-board	4,080.2	22,143
Secondary Pulp and Paper	6,361.7	40,362
Grand Total	22,074.4	169,200

Total Economic Impact in East Texas, 1999

Sector	Industrial Output	Employment
	Million dollars	Jpbs
Forestry	828.3	7,199
Logging	748.2	5,446
Primary Solid Wood Products	3,189.9	22,531
Secondary Solid Wood Products	2,097.4	19,525
Primary Paper and Paperboard	3,353.8	17,998
Secondary Paper and Paperboard	723.2	4,610
Grand Total	10,941.0	77,309

Timber Property Taxes

Property taxes are a vital component of the tax structure for local government, public schools and special taxing units. In 2004, timber tax appraisal roll values for all counties in East Texas totaled $1.9 billion. While timberland typically represents approximately one to ten percent of a county's total property tax appraisal roll value, in some more rural counties, timberland values represent as much as 38 percent.

The Timber Productivity Tax System assesses timberland on an income capitalization method for crop production versus market value. Given the long-term nature of growing timber, a market value approach to taxing the value of standing timber annually would tax the same growth in a compounding manner for 30 years or more.

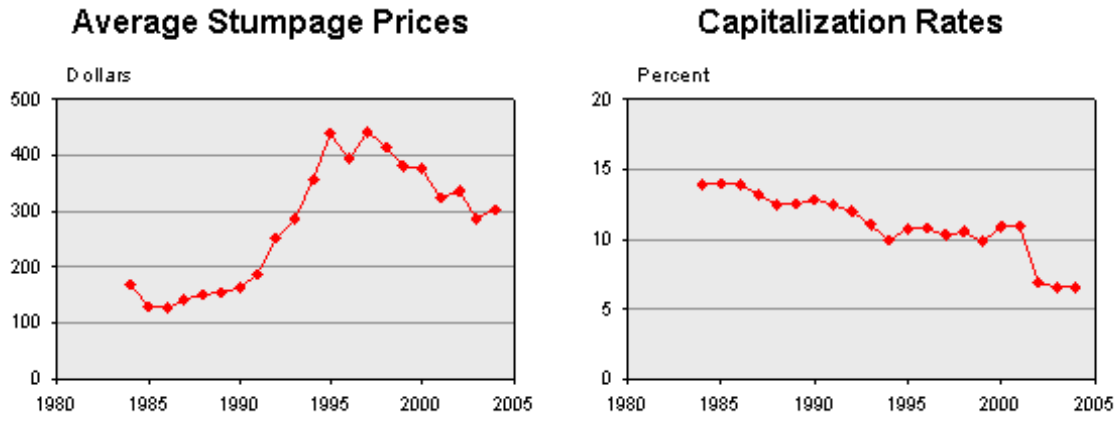
This system was originally established in 1978 when Texas voters approved a constitutional amendment that provided for assessing the value of open space and forest lands on their capacity to produce a crop. The timberland appraisal standards and procedures, as set forth in the *Manual for Appraisal of Timberland* by the Texas Comptroller of Public Accounts, were revised in 1996 in response to concerns over the appraisal disparity between Northeast and Southeast Texas, discretion in management costs by the county appraisal districts and the accuracy of timber prices. In 2002, plummeting interest rates would have driven timber valuations up by 57 percent without further modifications to the appraisal method and data calculations. East Texas legislators, the State Comptroller's Property Tax Division, Texas Forest Service, chief appraisers and timber growers worked together and came to the collective decision to include gatewood timber prices in the *Texas Timber Price Trends* report and recognize small pine sawtimber as a timber product for tax purposes. These changes made the report representative of the entire market and corrected one of the major inequities in the tax system.

Changes to Tax Appraisal Procedures

In 2003, the Legislature officially codified the inclusion of small pine sawtimber as a product and included gatewood in timber prices in Senate Bill 1646. This bill further improved the system by merging Northeast and Southeast Texas, stabilizing the capitalization rate (Texas Farm Credit Bank rate on December 31 plus 2.5 percent) and using tons as the measure for growth and price data. To reduce appraisal volatility, the annual capitalization rate will be replaced with a five-year moving average. Timber prices and capitalization rates were the two largest drivers in valuation changes from 1984 thorough 2004 (Figure 13).

The impact of SB 1646 on the appraised value was estimated to be a 5-percent decrease in the total timber valuation for East Texas as a whole in 2004. Individual tracts were

Figure 13. Average stumpage prices and capitalization rates in Texas from 1984 to 2004



affected differently than the regional aggregate valuation. The new cap rate reduced value by 3 percent that year, while declining timber prices reduced valuation by 14 percent. In 2005, the new forest inventory growth data caused an increase in timberland valuation for East Texas as a whole due to the increased growth rate, increased volumes in larger timber, shifting acreages in site classes and more accurate hardwood growth calculations.

Special Appraisal for Environmental Zones

Another significant forestry tax law in Texas was SB 977 of 1999 — the Texas Reforestation and Conservation Act of 1999. This law, effective January 1, 2000, reduced the appraisal value by 50 percent for reforested land and for lands established for protecting water quality, aesthetics, critical wildlife and preserving sites with historical or cultural importance. This act also established sales tax incentives for timber growers.

Timberland Tax Mapping

A key component to further improve appraisals is current timberland maps at the county level. County chief appraisers use maps to determine acreage of specific parcels by timber type and soil productivity category. Many East Texas timberland maps are decades old. Developing updated maps on a five-year cycle matching the forest inventory data for all East Texas is critical for accurately appraising timberland. County appraisal districts need current information, preferably in a computer-driven geographic information system (GIS), to conduct appraisals.

Of the 10.9 million acres of private commercial timberland in East Texas, only 7.7 million acres were enrolled in timber use valuations in 2004. If chief appraisers and the Comptroller's Office were equipped with current map information, they could ensure that the missing 3.2 million acres of private forest land that are not currently enrolled under timber use are properly classified and taxed. However, developing current timberland maps can be a significant expense for most counties and prohibitive for poorer counties. To prepare these maps accurately, current imagery must be obtained and processed at the correct scale, with the proper film type and at the proper time (during the leaf-off season). Texas Forest Service has capabilities for producing digital orthophotos, the foundation for a GIS database; however, this operation would have to be expanded to cover all of East Texas on a five-year cycle to produce tax maps. There may be an opportunity for cost saving for counties by centralizing the development of timberland tax maps. These maps could satisfy the mapping needs of chief appraisers and the Comptroller's Property Tax Division.

Environmental Impact

Clean Water

The link between forests and clean water has been well documented. Forests perform a critical role in providing and maintaining clean water. Forested lands absorb rainfall, filter runoff, reduce flooding and provide habitat for both wildlife and aquatic life. Forests produce the highest quality of water of any land use due in large part to the efforts of the entire forestry community.

Clean Water Act of 1972

The Clean Water Act (CWA) was passed in 1972 to address the then increasingly polluted waters of the nation. Section 303(d) of the CWA required states to develop a list of waters not meeting water quality standards or supporting the designated uses of the water body. Initially, the CWA focused on reducing point sources of pollution — identifiable sources such as the end of a pipe. The Water Quality Act of 1987 amended the 1972 Clean Water Act and shifted the national focus from point source pollution to non-point source (NPS) pollution — that from a non-distinct or broad area and usually carried by rainfall runoff or percolation. The Water Quality Act of 1987 required states to assess and identify water quality problems arising

from NPS pollution. States were further required to develop policies and identify programs aimed at dealing with the NPS pollution problem.

In Texas, the Texas Commission on Environmental Quality (TCEQ) and the Texas State Soil & Water Conservation Board (TSSWCB) are both charged with addressing NPS pollution. The TCEQ administers all point source pollution abatement programs as well as some NPS pollution programs and has regulatory authority. The TSSWCB is the lead agency for planning, management and abatement of agricultural and silvicultural NPS pollution. The TSSWCB works with Texas Forest Service to administer the programs aimed at reducing silvicultural NPS pollution.

The TCEQ was given the responsibility of assessing the State's waters. The TCEQ produces a document, known as the 305(b) report, assessing the State's surface waters and whether they are meeting water quality standards. The 305(b) report is then used to compile what is known as the 303(d) list, which identifies the State's waters that are not meeting water quality standards and/or not meeting their designated uses.

Waters that do not meet standards and uses are considered to be "impaired." Once a water body is placed on the 303(d) list, the TCEQ must then develop a total maximum daily load (TMDL) for that body of water. A TMDL is basically a pollution budget for the body of water. Scientific data is gathered to determine the maximum amount of a pollutant that a lake, river or estuary can receive and still meet its designated uses and water quality standards. The TMDL allocates the allowable amounts of loading for both point and non-point sources of pollution. The U.S. Environmental Protection Agency (EPA) approves the 303(d) list and all TMDLs developed for impaired waters.

Best Management Practices

Texas Forest Service has implemented a broad program that involves the entire forestry community—private landowners, logging professionals, forest industry and other state and federal agencies. This program focuses on encouraging the forestry community to voluntarily implement what are known as best management practices (BMPs) during silvicultural operations. BMPs are practices or combinations of practices designed to prevent or reduce the amount of water pollution generated by forest-related non-point sources. The program consists of education, technical assistance, demonstration areas, monitoring and program coordination.

Texas Forest Service provides educational programs for landowners, foresters, loggers and other forestry professionals on NPS pollution and how they can prevent and minimize it on lands they own or on which they operate. This has been accomplished through workshops, forestry tours, publications and county landowner association meetings. Texas Forest Service is partnering with the Texas Forestry Association and forest industry to help deliver educational training to logging professionals. Approximately 2,700 logging professionals have attended an 8-hour training course on proper BMP implementation. An on-line BMP course was developed in 2004 to provide loggers with a refresher on the subject.

The major forest product corporations that utilize timber harvested and/or own land in Texas adhere to the Principals of the Sustainable Forestry Initiative (SFI™), which promote environmentally- and economically-responsible practices. They require BMPs to be implemented on tracts of land they own or from which they procure wood.

Texas Forest Service conducts a BMP monitoring program that determines the percent implementation of BMPs being used during silvicultural operations. The BMP Implementation Monitoring Program began in 1991 to measure the degree of implementation with BMP guidelines by the forestry community, to evaluate the effectiveness of BMPs as applied

in the field and to identify any weaknesses in the BMP guidelines. With landowner consent, randomly chosen, "normal silvicultural" operations are evaluated for the presence of BMPs and whether they are functioning properly. This cooperative, non-regulatory program is completely voluntary. The current level of overall BMP implementation is 91.7 percent, the highest rate since the program began. The BMP Program in East Texas has been extremely successful; in fact, there are no water bodies listed in the *2004 Texas Water Quality and 303 (d) List* due to silvicultural practices.

In addition to the BMP Implementation Monitoring Program, Texas Forest Service, in cooperation with EPA, Texas State Soil and Water Conservation Board and the forestry community, is currently collecting data to test the overall effectiveness of BMPs. This project tests what, if any, biological and/or chemical effects occur to water quality after a timber harvest operation when BMPs are properly followed. The project includes plans to monitor and test selected streams for one year, harvest tracts of trees near the streams and then test the streams for two more years to capture any changes associated with harvest. The expected results of this study will be to verify that BMPs are environmentally sound practices conducive to maintaining good water quality or to show the need to revise the current BMP guidelines.

Water Reservoirs

Three proposed water reservoirs in East Texas recently have drawn considerable attention. Advocates and opponents of constructing new reservoirs have valid reasoning for their positions. Texas will need additional large quantities of water to meet future needs of its growing population. There have been no reservoirs larger than 25,000 acres completed in East Texas since 1980, when Lake Fork was established. In recent years, competing pressures over land use have changed, with the most significant issue elevating concerns in the forestry community being federal requirements for mitigating the impact of these projects on wetland functions. A conservative estimate is that the proposed reservoirs could collectively take anywhere between 0.5 and 1.7 million acres of commercial timberland out of production, assuming all three projects are mitigated per current federal guidelines.

Growing urban areas in Texas will need more water in the years ahead, and reservoir sites will be sought in East Texas because of its presumed low cost of water availability. However, it is important to consider the tremendously negative economic impact of these reservoirs to the region's forest-based economy. Federal guidelines include timber production as a vital wetland function, but in practice only the wildlife function is given serious consideration, and little regard is given to adverse impact on these rural economies. It is essential that, as part of the review of these large projects, economic analyses be made by qualified forest economists and options included based on inputs from knowledgeable forestry experts that minimize local economic and social hardships.

As an alternative to taking acres out of timber production, water reservoirs could likely be established with much less negative impact to the forest-based economy of the region by creating replacement hardwood forests years ahead of building the reservoir. These new forests could sustain the timber base that is critical to the local economy and support wildlife and other wetland functions. These forest reserves could be established on private lands with funds provided by the ultimate users of the future water project.

U.S. and Southern Timber Resource Supply and Demand

The 2000 Forest and Rangeland Resource Planning Act (RPA) assessment (Haynes et al., 2002) projects that the character and location of timber and timber products output will change over the next 50 years. The base projection shows the area of forest land is expected to decline by 3.6 million acres in the South and 19.6 million acres elsewhere. It projects that privately-owned forests in the U.S. will be more intensively managed and production will continue its shift toward the South. Domestic consumption of softwood in the base projection will increase 47 percent and hardwood will increase 29 percent between 1996 and 2050. Timber harvest nationally will increase 30 percent for softwood and 17 percent for hardwood. The southern share of national softwood harvest will increase from 61 percent in 1997 to 65 percent by 2050. Softwood lumber and pulp and paperboard production are expected to increase most in the South, especially the western portion of the region. Hardwood and softwood timber harvests are projected to increase by more than one-third in the coming half century. The RPA assessment projects the U.S. will increase its dependence on foreign sources of wood fiber as a proportion of total consumption, rising to 27 percent by 2050 compared to 20 percent in 2000. Timber prices in the South are expected to rise sharply for softwood logs but decline for pulpwood, whereas hardwood log and pulpwood prices are expected to double. Rising values could lead to significant innovation in hardwood management that could boost supplies beyond the level projected in this assessment.

As part of the Southern Forest Resource Assessment, projections were made of forest area, harvest, growth and inventory using the SRTS Model, FIA data and the National RPA Assessment. Forestland gains are projected for Alabama, Mississippi, Louisiana and Arkansas. Losses are projected for Florida, North Carolina, South Carolina, Virginia, Tennessee and Texas. Most of the gain in growth comes from converting natural forests to pine plantations, producing a 50 percent improvement in growth. About 30 percent of the new plantation acreage comes from conversion of former agriculture land driven by rising timber prices relative to agricultural rents.

Softwood harvests are projected to increase by 56 percent between 1995 and 2040 under the base case scenario. Plantation acreage is projected to increase from 30 million acres in 1997 to 53.6 million acres in 2040 — an increase of 24 million acres. Growth in hardwoods is expected to exceed removals until 2025.

Despite increasing production from the South and its increasing production from pine plantations, output is not projected to keep pace with demand, and higher prices are projected as a result. This will lead to rising product imports and continued changes in product manufacturing technology to partially offset higher timber cost. Even with substantially higher plantation acreage, natural forest types will continue to dominate. As the author states, the details of projections are notoriously unreliable and though very important for planning purposes, they should be viewed with caution (Prestemon, 2001).

Market opportunities in Texas are very positive given that projections of population growth show an increase of 12 million over the next 20 years. Also, the South is the only region in the U.S. where timber supplies are expected to increase over the next two decades. This assumes that leaders in the forestry community at all levels develop a common vision and financial commitment to build a forest resource base sufficient to meet future needs.

Softwood productivity increases of 30 to 40 percent or even more may be achievable on industry lands, and biologically possible on family forestlands. Success in implementing intensive practices across all private ownerships will determine the ability to maintain fiber supplies and reasonable price levels. Forest industry has already responded to relative softwood timber scarcity by rapidly increasing the intensity of its timber management. These

productivity increases must be extended to a greater portion of family forestland for both softwood and hardwood (Cubbage and Apt, 1998).

Opportunities for Texas

The softwood growing stock growth shortfall of 47.2 million cubic feet annually on the family forest ownership in Texas is the most serious issue the forestry community and policy makers must address if the resource base and industrial output are to be sustained. There is a surplus of softwoods on industrial land. However, a vital aspect of timber supply is that it must be of the right types in terms of species group, size and geographic location. Thanks to the large standing timber inventory, there is time to correct resource shortfalls and avoid losing existing manufacturing capacity.

There are adequate opportunities in the region to expand production sufficient to achieve sustainability and boost the resource base for future economic development. A significant amount of land owned by family forest owners is producing far below its economic potential, robbing the owners and their heirs of better future returns from this land. Also, the local forest-based economy suffers due to the lost opportunity of attracting more industry and having a weaker property tax base. Many of these owners are not making the needed capital investments due to small timberland ownership (fragmentation issue) and their age (approximately 44 percent are over 65 years of age), given it takes 30 years to produce a timber crop. There is also the issue of the large, front-end capital investment in light of future uncertainties.

Ecological Services

Water Credits

Ecological services offered by forestlands provide a new, globally-oriented frontier for forestry. Wetland mitigation is an example of an ecological service that has emerging market opportunities. Texas policy makers have big challenges ahead to develop water sources to meet future needs, given the large increases expected in population, especially in urban areas. More surface reservoirs are likely in East Texas, producing conflict with the hardwood industry of that region. However, there are ways in which this could become a win-win situation for water users and forestry interests. If market-driven mitigation strategies were implemented on a sufficient scale on private land with enough lead time, interested parties with adequate incentives could develop replacement forests prior to reservoir construction on former agricultural lands subject to flooding. Lands would remain in private ownership and on local tax rolls. The timberland would remain working lands, generating economic activity and supporting wetland functions of wildlife habitat and watershed protection at no additional cost to the public.

Carbon Sequestration

Forest carbon sequestration represents another ecological service that forests can provide. This service has received considerable attention recently due to its impact on global climate change, and specifically due to its inclusion in the Kyoto Protocol. The Kyoto Protocol was established in December 1997 by the parties to the United Nations Framework Convention on Climate Change (UNFCCC) with the goal of enforcing legally binding steps for participating countries to take to combat global climate change. To accomplish this, the Protocol defines target levels for emissions reductions as well as mechanisms by which participating countries can fulfill their reduction requirements. Participating developed countries are required to reduce emissions of carbon dioxide gases by approximately 5 percent of their 1990 levels by 2008–2012, though legally binding limits are not placed on developing countries. More than 120 countries (excluding the U.S.), including the European Union and most of its member countries have ratified the agreement.

With Russia's ratification in October 2004, participation was sufficient to meet the required 55 percent of the 1990 level of emissions for the Protocol to become binding for participating countries, which occurred in February 2005.

Kyoto mechanisms to reduce greenhouse gas (GHG) emissions include both directly reducing the amounts of GHGs released into the atmosphere and capturing GHGs from the atmosphere and storing or sequestering them. Carbon can be sequestered in the form of CO_2 in geologic formations, oceans and in terrestrial organisms (vegetation and soils). Forest carbon sequestration is a specific type of vegetation sequestration that takes advantage of a forest's ability to absorb and store CO_2. However, while growing forests sequester carbon, deforestation emits carbon to the atmosphere. Therefore, in response to the effect both standing and harvested forests have on GHGs, the Kyoto Protocol requires all participating industrialized countries to record credits and debits of carbon stock changes resulting from afforestation, reforestation and deforestation that have taken place since 1990. During the first commitment period, special waivers may be obtained for debits resulting from harvesting short-rotation forests and also to net debits that occur for many parties when newly established young forests cannot offset debits from clearing older, established forests.

Specific allowances limit the credit that countries may acquire or lose annually from forest management of forests established since 1990. These allowances reflect the lower of two values — 15 percent of the annual forest carbon stock change or three percent of total carbon emissions in 1990. In discounting carbon sequestration increases by 85 percent in forests established prior to 1990, the UNFCCC and subsequent conferences factor out benefits from routine planting of the young, rapidly growing forests that are dominant in most developed countries.

As stated, under certain conditions, human-induced increases in carbon sinks, e.g. planting forests, can offset carbon emissions. Also, as a renewable source of energy, wood can substitute for non-renewable energy, thus reducing net emissions of carbon. Carbon is also stored in forest products. While tissue, paper, pallets and packaging material may store carbon for short periods of time, lumber, panels and paper in books can store carbon for considerably longer. Since forests products are made from renewable resources and relatively little fossil fuel is used to manufacture them, they can substitute for non-renewable energy intensive materials, and thus help combat global climate change. (Source: UNECE/FAO Forest Products Annual Market Analysis, 2002-2004).

Also of note is the cap-and-trade system developing in the E.U. as a result of the Kyoto Protocol to help E.U. members comply with their Protocol commitments. E.U. members under this system can trade emissions credits among themselves to allow those with higher abatement costs to acquire credits from countries with lower abatement costs. Credits obtained through afforestation and reforestation projects are allowable in this system.

In March 2001, President Bush rejected the Kyoto Protocol, saying it would burden the economy by limiting the use of still abundant fossil fuels. However, though the U.S. has not ratified the Kyoto agreement, it is working to reduce GHGs on a voluntary and incentive basis. Many companies that operate in international markets are instituting programs to reduce GHG emissions in their U.S. operations. Additionally, foreign companies with subsidiaries in the U.S. are also taking actions to mitigate GHGs in their U.S. operations.

Biomass Availability

Currently, there is substantial interest in using biomass (plant matter) from logging and mill residue for energy production and chemical extraction in East Texas. To meet the demand for quality data on the availability of resources in the region, Texas Forest Service produced tables quantifying logging residue and mill residue in East Texas in 2003. The residue

data was estimated based on a mill survey conducted by Texas Forest Service (Xu, 2004) and a wood utilization study published by the U.S. Forest Service (Bentley and Johnson, 2004) which covers the 43 counties of East Texas.

Logging Residue

Types of logging residue include **stumps, tops, limbs**, and unutilized **cull trees**. **Stump** residue, the part of the tree that is lower than the cutting point and thus left after the harvesting operation, is generally not available commercially since the cost of extracting the stump or root biomass is likely prohibitive. **Tops** refer to the tops of trees that are either broken during harvesting or are cut off the central stem of the tree due to a merchantability standard. *Limbs* refer to the branches of trees. **Cull trees** are those that cannot be used to produce sawlogs due to defects, rot or form. Some cull trees are used as pulpwood and others are left unutilized as a part of logging residue. Tops, limbs and unutilized cull trees are the logging residue that is potentially available as biomass for energy production or chemical extraction.

A total of 3.4 million tons of logging residue were generated in East Texas in 2003 — 69 percent from softwood and 31 percent from hardwood. Tops, limbs, and cull trees accounted for 2.8 million tons, while 0.6 million tons were from stumps.

Mill Residue

Mill residue, including *chips*, *sawdust*, *shavings* and *bark*, is generated in the process of producing primary wood products. The major primary wood products produced in East Texas include lumber, plywood, veneer, OSB, chips and posts/poles. Chips as a primary product are produced from pulpwood roundwood and residue chips are produced from the tops of sawlogs that are used for producing lumber, veneer or plywood. Sawdust is produced from sawing lumber from sawlogs, and shavings are produced from lumber surfacing. All primary products have bark as mill residue.

A total of 5.9 million tons of mill residue were produced in East Texas in 2003, with 85 percent from softwood and 15 percent from hardwood. Chips accounted for 50 percent of the total mill residue, followed by bark at 36 percent. Sawdust and shavings accounted for eight percent and six percent, respectively, of the total mill residue produced in East Texas in 2003.

East Texas has substantial biomass in the form of logging and mill residue. Except for stumps, all biomass from logging and mill residue is available for energy production or chemical extraction. Most logging residue in East Texas is not utilized and is left at the logging sites. However, most mill residue in East Texas is marketed for competing uses, such as chips for pulping, sawdust, shavings and bark for fuel or landscaping. It is important to note that logging residue is generated on logging sites, while mill residue is produced in mills. This means that the amount of logging residue from a county is associated with the timber harvest in that county, while the amount of mill reside in a county is associated with the production of the amount and types of primary forest products in that county. This also means that part of the mill residue in Texas could be generated from wood shipped to Texas mills from other states.

Expansion of the East Texas Economy

New Mills

The surplus timber supply in Southeast Texas presents an excellent opportunity for a new OSB facility having an annual production capacity of roughly 600 million square feet. Such a facility could cost close to $180 million to build and could employ approximately 180 workers in manufacturing jobs while generating approximately 260 logging jobs. This mill could have a total annual economic impact of $169 million on the Texas economy and generate 551 new jobs.

The surplus of timber resources also could likely support a small-log pine sawmill, especially if additional reforestation occurs to contribute to long-term sustainability. A small-log sawmill having a production capacity of 150 million board feet of lumber could employ 160 mill workers and have a direct economic impact of $87 million. Total economic impact would be $230 million and 418 jobs.

The surplus hardwood timber supply could support a grade hardwood mill in Southeast Texas. Such a mill might have a production capacity of 20 million board feet and employ 50 people with a direct economic impact of $11 million. Improvements on the marketing of hardwood timber can be made so that better quality timber is directed to grade sawmills in Texas. Once grade lumber production is increased, there will be opportunities to attract flooring, cabinet, millwork and furniture operations to the region.

Grade Hardwood Lumber

Another exciting opportunity to expand the forest-based economy of East Texas is with value-added opportunities in the hardwood resource. Historically, East Texas has been a significant hardwood lumber producer; however, most of the production has been lower-valued railroad ties and pallet lumber. Railroad ties are commonly cut from grade 2 or 3 red oak logs. Ties are currently selling at about $21 per tie, which equates to $450 per MBF, based on a tie yielding 47 board feet in sawn lumber. Generally, ties are center-cut material, thus of lower value than side lumber. However, in the absence of strong lumber markets, high-quality logs are commonly sawn into lower-valued products, like ties and pallet cants. This same grade of wood could be sold into higher value uses such as strip flooring.

More opportunity exists to increase grade lumber production by encouraging and providing technical assistance to existing mills on best practices to capture higher lumber grades, such as 4/4 red oak FAS and #1C, which sells for $1,040 and $580 per MBF green, respectively (*Hardwood Review Weekly*, 05/26/06). Currently, only about 10 percent of lumber sawn at Texas mills is grade lumber. There is only one large, highly-optimized hardwood sawmill in Texas that maximizes lumber recovery from logs and grade recovery from sawn lumber. Lumber grading requires specialized knowledge and skills, so technical training would be required.

Yet even more value-added opportunity exists in increasing capacity of drying and finishing green lumber. While drying and finishing operations exist, there is currently very little capacity in East Texas. More expansion is needed to tap the growth potential from this segment of the industry. Value of lumber increases significantly when it is graded, dried and finished. Red oak FAS 4/4 grade lumber value can increase from a spring 2006 price of $1,040 per MBF of green graded lumber to $1,460 per MBF for kiln-dried and finished lumber. Unfortunately, Texas has not developed the grade lumber aspect of this industry as well as Arkansas and Louisiana. As a result, much of the better grade logs and grade green lumber is shipped to out-of-state mills.

Elder Process

Hardwood lumber drying in the South is subject to hot and humid weather that promotes enzymatic stain in sapwood. Chemical dipping is the most commonly used method of preventing enzymatic stain. However, its application is only topical and does not prevent stain. A private operator, Danny Elder of Jasper, Texas, developed, through trial and error, a pre-drying treatment method called the Elder Process. The claimed benefits of the Elder Process include prevention of enzymatic stain; darkening sapwood color which more closely match that of heartwood and increases color consistency of lumber; reduction of drying degrade; and reduction in air drying time.

At the request of the local hardwood industry, Texas Forest Service conducted a study to verify these claims. More than 13 thousand board feet of freshly sawn southern red oak boards were divided into four treatment groups – Chemically dipped, not Elder Process treated; Chemically dipped, Elder Process treated; Not chemically dipped, Elder Process treated; and Not chemically dipped, not Elder Process treated (control group). The emphasis was on comparing the Elder Process to chemical dipping.

Color measurements among treatment groups showed that the Elder Process had a significant effect on sapwood color changes during lumber drying while chemical dipping did not. Color change clearly showed that the Elder Processed lumber had a brighter color than other treatment groups and had an orangey tint in the sapwood. Although the Elder Process enhanced the color of sapwood to more closely resemble the color of heartwood, the colors of heartwood and sapwood remained different. Heartwood color was not affected by treatment.

The Elder Process was very effective in minimizing enzymatic stain on sapwood and reducing drying degrade. The chemically dipped-only treatment had little effect in combating enzymatic stain on sapwood and drying defects and the combination of chemical dipping and the Elder Process did not have significant advantage over the Elder Process-only treatment.

The ability of the Elder Process to reduce drying defects over the chemical dipping treatment translated into potential financial gains. This study showed that the Elder Process minimizes enzymatic stain and reduces drying degrade. The potential financial gains from the reduced drying defects and degrade may help the southern hardwood industry compete more effectively with northern hardwood and Appalachian hardwood industries that have less enzymatic stain problem. However, the financial gains from this study were theoretically calculated based on the difference in drying degrade among treatment groups. Further study on the market acceptability of the Elder Processed lumber is necessary to better understand the real financial gain.

The economic impact of these proposed opportunities is shown in Tables 3 and 4.

Direct Economic Impact

Table 3. Economic Impacts for Proposed New Mills in East Texas

Mill Type	Capacity	Output $ million	Value Added $ million	Employment	Labor Income $ million
Pine Sawmill	150 million BF	46.7	11.6	160	8.1
Hardwood Grade Mill	20 million BF	11.0	5.1	50	1.5
Four Drying and Finishing Mills	20 million BF	21.6	10.0	40	1.2
Oriented Strand Board Mill	625 million SF	213.6	67.6	180	34.2
Total		292.9	94.3	430	45.0

Total Economic Impact

Table 4. Economic Impacts for Proposed New Mills in East Texas

Mill Type	Output $ million	Value Added $ million	Employment	Labor Income $ million
Pine Sawmill	94.7	37.1	418	23.4
Hardwood Grade Mill	21.7	10.9	86	2.7
Four Drying and Finishing Mills	42.5	21.4	68	2.2
Oriented Strand Board Mill	414.5	175.2	551	97.4
Total	573.4	244.6	1123	125.7

Future Resource Development

Currently, the 3.4 million acres of industry and investor-owned timberland support 38 percent of the total East Texas timber harvest. Family forestlands, which supply 56 percent of the timber harvest, are harvesting 47.2 million cubic feet in excess of growth annually. This creates a timber deficit with negative long-term consequences. Creation of a business environment in which the dominant family forest resources return not just to a level of sustainability, but to a level beyond that which will increase the resource availability to support future economic growth opportunities, is essential for East Texas. The major challenge will be identifying incentives for family forest landowners to commit financial resources to overcome this timber growth deficit by making reforestation a standard practice. Presented below are two options to help restore forest sustainability and build a resource base for the future.

Forest Sustainability Option

The first is the Sustainability Option — the minimum reforestation program needed to boost annual growth sufficiently to sustain current harvest levels without depleting the timber resource base. This assumes that the current surplus on corporate lands will be utilized to meet current market needs as previously discussed. Under the Sustainability Option, two scenarios are presented. The first scenario focuses on converting former agriculture land to forest and gives the most net production since it creates new forests that are not part of the existing resource base. To meet current needs for resource sustainability, this scenario would require planting 37,400 acres per year at a total cost to the landowners of $7.1 million per year. Costs include site preparation, seedlings, planting, controlling weed competition and technical assistance for the landowner to plan and coordinate the project. Over a period of 10 years, this option would result in planting a total of 374,000 acres and be capable of resulting in the production of 45 million cubic feet of timber growth per year. Total cost to landowners is $71 million over the 10-year period. To prevent landowners from assuming all the risk for these forests that provide societal benefit, external funding could provide assistance to cover 75 percent of the initial establishment expenses (Table 5). After establishment, local property taxes and maintenance expenses would be borne solely by the landowners.

If landowners' willingness to convert their agricultural land to reach this target of 37,400 acres per year proves unrealistic, another scenario with a combination of planting open agricultural land and reforestation of under-stocked or cutover forests is possible. This alternative scenario of planting agricultural land and cutover forest land treats 41,000 acres per year at a total cost to the landowners of $11.4 million per year. Table 5 shows the cost with 75 percent of the cost shared by external funds.

Economic Growth Option

The Economic Growth Option, which establishes the opportunity for significant future growth to place East Texas in a competitive position to attract world-class forest industry, has two scenarios as well. Again, the first scenario is conversion of open agriculture lands to forest land. With sufficient landowner interest, this option would treat 74,800 acres each year at a cost to landowners of $14.2 million per year. After 10 years, this scenario would plant 748,000 acres capable of producing an additional 90 million cubic feet of annual softwood production. This compares to the current level of annual growth on family forests of 235 million cubic feet, with current harvest levels at 280 million cubic feet per year.

The second scenario with a combination of openland (45 percent) and cutover forest land (55 percent) calls for planting 82,200 acres per year at an estimated total cost to the landowners of $23 million per year. After 10 years under this scenario, 822,000 acres would be planted and an additional 81 million cubic feet of softwood annual growth would be produced.

Table 5. Options to Restore Forest Sustainability

Alternative I - Sustainability				
Options (in years)	Treatment Area (in thousands acres)	Landowner Cost (In thousands dollars)	Cost Share Payments	Timber Growth (in thousands cubic feet)
A. Conversion of Former Agriculture Lands to Timber				
Annually	37,400	7,106	5,330	4,490
Ten Years	374,000	71,106	53,330	44,900
B. Combination Conversion of Agriculture Lands and Reforestation				
1. Conversion of Agriculture Lands				
Annually	18,700	3,553	2,665	2,244
Ten Years	187,000	35,530	26,647	22400
2. Reforestation				
Annually	22,400	7,930	5,947	1,792
Ten Years	224,000	79,300	59,470	17,920
3. Total - Conversion and Reforestation				
Annually	41,100	11,483	8,612	4,036
Ten Years	411,000	114,830	86,120	40,320
Alternative II - Economic Growth				
Options (in years)	Treatment Area (in thousands acres)	Landowner Cost (In thousands dollars)	Cost Share Payments	Timber Growth (in thousands cubic feet)
A. Conversion of Former Agriculture Lands to Timber				
Annually	74,800	14,212	10,659	8,976
Ten Years	748,000	142,120	106,590	89,760
B. Combination Conversion of Agriculture Lands and Reforestation				
4. Conversion of Agriculture Lands				
Annually	37,400	7,106	5,329	4,488
Ten Years	374,000	71,060	53,290	44,880
5. Reforestation				
Annually	44,800	15,859	11,894	3,584
Ten Years	448,000	158,900	118,944	35,840
6. Total - Conversion and Reforestation				
Annually	82,200	22,965	17,224	8,072
Ten Years	822,000	229,650	172,240	80,720

The external cost for sharing 75 percent of the cost in this scenario would be $17.2 million per year, not including any cost of program coordination and administration.

These options assume annual growth on converted agricultural land to be 120 cubic feet/acre and net annual growth gain on reforested land of 80 cubic feet versus no treatment. Estimated average cost to convert agricultural land is $190 per acre and to reforest cutover forest land is $354 per acre. These costs include those for intensive site preparation, seedlings and planting, competition control and technical assistance.

Regardless of options considered for boosting annual softwood growth to a sustainable level or to build a timber surplus to boost future economic growth, efforts have to be in addition to the current annual 42,500 acres of annual tree planting currently being done on family forestlands in East Texas.

Nursery and seed orchard capacity must also be considered in long range planning. Current nursery capacity exists to meet current tree-planting efforts. The proposed options will require an additional 49 to 53 million seedlings per year at a planting rate of 650 trees per acre. This would require enlarging private and public nurseries, building a new public nursery or a combination of both. A quality seed source of the best genetic gain geographically suited to the sites is required.

A significant aspect of increasing resource growth is reducing losses to fire, as well as to insects and diseases. Additional fire crews and equipment will be needed to protect this investment. New plantations are very costly to establish and will be exposed to significant risk if not properly protected.

Encouraging economically feasible, intensive forestry is an essential component to expanding the future resource base. Future needs cannot be met by relying solely on family forests. A public/private partnership to create a forest resource base large enough to meet the forest needs of a growing public and absorb losses associated with urban expansion is crucial. Incentives currently exist to encourage landowners to invest in reforestation, including federal reforestation tax incentives, which Congress recently expanded to allow full deduction of reforestation expenses over a period of seven and one-half years. However, current incentives have not been sufficient to create a sustainable resource, much less a resource that will encourage significant future economic development in the forest sector.

Programs that protect forests from fires, prevent timber thief, provide technical assistance with tree breeding and integrated pest management, inventory the forests, provide technical assistance to enhance the value of wood products, develop policy on forest taxation issues and protect water quality are vital to the success of building a strong resource base for the future. These programs are important to the overall supply picture and must be considered in developing comprehensive strategies to build a sustainable future resource.

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